

REMARKS

Claims 1-40 remain in this application. Claims 1, 4-9, and 12-33 have been cancelled without prejudice. Claims 2, 3, 10, and 11 have been amended. Claims 34-40 are new. Reconsideration is respectfully requested.

Applicant is not conceding that the subject matter encompassed by the claims prior to this amendment is not patentable. Claims 1, 4-9, and 12-33 were cancelled in this amendment solely to facilitate expeditious prosecution of the subject matter of claims 2, 3, 10, 11 and 34-40. Applicant respectfully reserves the right to pursue claims, including the subject matter encompassed by the claims as presented prior to this amendment and additional claims, in one or more continuing applications.

The Examiner objected to an amendment to the specification in applicant's communication of 12 May 2008, stating that the amendment introduced new matter into the disclosure. While respectfully disagreeing with the grounds of objection, in the interests of expediting prosecution of the application applicant has amended the paragraph beginning at page 16, line 23, so that the amended paragraph is as in the original disclosure. In view of the amendment, applicant requests that the objection be withdrawn.

The drawings were objected to under 37 CFR 1.83(a) as failing to show "a processor in the cache." In view of the amendment to the specification, applicant requests that the objection to the drawing be withdrawn.

Claim 27 was objected to because of an informality. Claim 27 has been cancelled, so the objection is moot.

Claims 1, 4-9, and 12-33 were rejected under 35 U. S. C. §112, first paragraph. Claims 1, 4-9, and 12-33 have been cancelled, so the rejections are moot.

Claims 2, 3, 10, and 11 were rejected under 35 U. S. C. §112, first paragraph as depending from claim 1 (rejected as stated above). Applicant has amended claims 2, 3, 10, and 11 to depend directly or indirectly from a new independent claim 34, argued below. In view of the amendment, applicant believes that the rejections should be withdrawn.

Claim 1 was rejected under 35 U. S. C. §102(e) as being anticipated by Hicken et al. ((US Patent Application 2004/0153727). Applicant has cancelled claim 1 so that the rejection is moot. Applicant has written a new independent claim 34 in place of claim 1. As argued below, claim 34 recites limitations which distinguish and clarify over the cited art. The limitations of claim 34 are supported in the specification at page 1, lines 17-19; page 17, lines 12-24; page 19, line 27 - page 21, line 11; page 23, lines 7-12 and Fig. 3; page 29, lines 22-28; and page 31, line 15 - page 34, line 33 and Fig. 8.

New independent claim 34 recites a data storage system having caches and storage devices. A first storage device is connected only to a first cache by a first coupling. The first cache is configured to contain dirty cache-data portions and clean cache-data portions corresponding to respective device-data portions stored on the first storage device, so that a given cache-data portion and its respective device-data portion are addressable at a given logical address.

Second caches are connected to respective storage devices by respective second couplings, so that each second storage device is connected to only one second cache.

First copies of the dirty cache-data portions are duplicated in the second caches so that each dirty cache-

data portion is redundantly stored on the first cache and one of the second caches. First copies of the device-data portions are distributed over the second storage devices so that each device-data portion is also redundantly stored on the first storage device and one of the second storage device. In addition, the first copy of a given dirty cache-data portion and the first copy of the corresponding device-data portion are addressable at the given logical address.

Incorrect operation of the first cache is detected, and the incorrect operation is recited to cause redundancy of the dirty cache-data portions and of the device-data portions to be lost.

In response to detection of the incorrect operation, second copies of the dirty cache data-portions are duplicated in the second caches, and second copies of the device-data portions are distributed over the second storage devices. The dirty cache-data second copy duplications are recited to be so that the given first copy of the given dirty cache-data portion and a given second copy of the given dirty cache-data portion are on different second caches, so that redundancy of the cache-data portions is recovered. The device-data second copy distributions are also recited to be so that the given first copy of the given device-data portion and a given second copy of the given device-data portion are on different second storage devices, so that redundancy of the device-data portions is also recovered.

Hicken describes a system for recovering cache data of a failed storage controller in a data storage system (Abstract). Hicken describes the structure of his system with regard to Fig. 1 and Fig. 3, stating that each storage controller is associated with a disk array (paragraph 22, lines 1-16, and paragraph 38 lines 1-16).

Each storage controller is described as having a primary cache and a secondary cache (paragraph 23, lines 1-9). Thus, in contrast to the requirements of claim 34, each disk of Hicken is not only connected to a cache by a respective coupling. Rather, each disk of Hicken is connected to two caches.

In addition, unlike further requirements of claim 34, there is no correspondence between data stored on either of the two caches of Hicken and one disk of the disk array coupled to the two caches. Rather, the primary cache of Hicken has stored data related to the disk array. The secondary cache stores "redundant data and control information related to the primary cache memory of another storage controller" (paragraph 23, lines 1-9).

Thus, Hicken neither teaches nor suggests storage devices that are connected only to respective caches, as is recited by claim 34. Furthermore, Hicken neither teaches nor suggests the correspondence between the data stored on a cache, and the data stored on a device connected only to the cache, as is required by claim 34.

In rejecting claims 26-33, 9-11, and 22-24 (addressed below), the Examiner cited Henry et al. (US Patent 6,898,666) and Karger et al. (Consistent Hashing and Random Trees: Distributed Caching Protocols for Relieving Hot Spots on the World Wide Web, Proc. of 29th ACM Symposium on Theory of Computing, pages 654-663), respectively. Henry describes a method for increasing the bandwidth of a computer using a single cache pool (Abstract). Karger describes a family of caching protocols using consistent hashing (Abstract). However, neither Henry nor Karger teach or suggest storage devices that are connected only to respective caches, nor do they teach or suggest a correspondence between the data stored on a cache, and the data stored on the device connected

only to the cache. Both the connection and the correspondence are requirements of claim 34.

Independent claim 34 is therefore believed to be patentable over the cited art.

Dependent claims 4-8, 12-21, and 25 were rejected under 35 U. S. C. §102(e) as being anticipated by Hicken. Claims 4-8, 12-21, and 25 have been cancelled so the rejections are moot.

Claims 2 and 3 were rejected under 35 U. S. C. §102(e) as being anticipated by Hicken. Claims 2 and 3 have been amended to depend directly or indirectly from new independent claim 34, and the language of the dependent claims has been amended to conform to that of the independent claim. In view of the patentability of independent claim 34, claims 2 and 3 are believed to be patentable, and to recite independently patentable matter.

Claims 26-33 were rejected under 35 U. S. C. §102(e) as being anticipated by Henry. Applicant has cancelled claims 26-33 so the rejections are moot.

Claims 10 and 11 were rejected under 35 U. S. C. §103(a) as being unpatentable over Hicken in view of Karger. Claims 10 and 11 have been amended to depend indirectly from independent claim 34. In view of the patentability of independent claim 34, claims 10 and 11 are also believed to be patentable.

Claims 9 and 22-24 were rejected under 35 U. S. C. §103(a) as being unpatentable over Hicken in view of Karger. Applicant has cancelled claims 9 and 22-24 so the rejections are moot.

Claims 35-38 are new dependent claims which depend directly or indirectly from new independent claim 34. Claim 35 recites limitations derived from original claim 1. Claim 36 is supported in the specification in page 17,

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lines 19-22; claim 37 finds support in page 26, lines 3-5 and page 27, lines 3-5; and claim 38 finds support in page 29, lines 10-14. In view of the dependency from claim 34, claims 35-38 are believed to be patentable over the cited art.

Claims 39 and 40 are new dependent claims which depend from independent claim 34. Claims 39 corresponds to claim 9 (now cancelled); and claim 40 is based on claim 25 (now cancelled). In view of their dependency from claim 34, claims 39 and 40 are believed to be patentable over the cited art, and are believed to recite independently patentable limitations.

Applicant believes that the above amendments and remarks are fully responsive to all of the grounds of objection and rejection raised by the Examiner. In view of these amendments and remarks, applicant respectfully submits that all of the claims currently pending in the present application are in order for allowance. Notice to this effect is respectfully requested.

Respectfully submitted,

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